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THESIS

MULTIPLE MODEL ELECTRONIC EQUIPMENT MANAGEMENT BY THE UNITED STATES NAVY

by

Daniel Reid Smoak

December 1983

Thesis Advisor: A. W. McMasters

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Electronic equipments which have multiple models in service create special logistics support problems for the Navy. This thesis concentrates on the management of multiple model electronic equipment at the Naval Electronic Systems Command (NAVELEX). The causes of multiple models include changes in operational requirements, initial design deficiencies, non-supportability of the equipment and incomplete technical data for procurement specifications. Parts support difficulties and

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the weak information interface between NAVELEX and the Ships Parts Control Center Mechanicsburg (SPCC) are discussed. Recommendations for improving this information flow, reducing the number of models of equipment and for providing required procurement technical data are made.

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Multiple Model Electronic Equipment Management by the United States Navy

by

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requirements for the degree of

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ABSTRACT

Electronic equipments which have multiple models in service create special logistics support problems for the Navy. This thesis concentrates on the management of multiple model electronic equipment at the Naval Electronic Systems Command (NAVELEX). The causes of multiple models include changes in operational requirements, initial design deficiencies, nonsupportability of the equipment and incomplete technical data for procurement specifications. Parts support difficulties and the weak information interface between NAVELEX and the Ships Parts Control Center Mechanicsburg (SPCC) are discussed. Recommendations for improving this information flow, reducing the number of models of equipment and for providing required procurement technical data are made.

TABLE OF CONTENTS

I. INTRODUCTION ---------- 9

A. INTENT ---------- 9

B. APPROACH ---------- 10

C. DEFINITIONS ---------- 10

D. ORGANIZATION ---------- 11

II. PROBLEM STATEMENT ---------- 13

A. REASONS FOR MULTIPLE MODELS ---------- 13

B. PROBLEMS RELATED TO MULTIPLE MODEL ITEMS ------- 16

C. SUMMARY ---------- 19

III. BACKGROUND ---------- 20

A. NAVELEX ---------- 20

B. NAVELEXDETMECH ---------- 24

C. SPCC ---------- 28

D. SUMMARY ---------- 33

IV. REPROCUREMENT PROCESS ---------- 34

A. NAVELEX REPROCUREMENT ---------- 34

1. Approval for Full Production Procedures ---- 37

2. Provisioning Guidance Conferences ---------- 38

3. Timing of MRP Availability ---------- 40

B. REPLENISHMENT BUYS FOR ELECTRONIC EQUIPMENT BY SPCC ---------- 41

1. Family Relationships ---------- 41

2. Acquisition Process ---------- 42

C. SUMMARY ---------- 45

V. FIELD CHANGES ---------- 47

A. CONFIGURATION CONTROL ---------- 47

B. FIELD CHANGE PROCESS ---------- 48

C. FIELD CHANGE PROBLEMS ---------- 51

D. SUMMARY ---------- 54

VI. CONCLUSIONS AND RECOMMENDATIONS ---------- 55

APPENDIX A - (SYSTEMS COMMANDS CRITERIA FOR IDENTIFYING RETENTION ITEMS DURING STOCK COORDINATION REVIEWS) ---------- 59

APPENDIX B - (BUDGET LEAD TIME FOR MAINTENANCE REPAIR PARTS) ---------- 62

APPENDIX C - (THE SPCC 7G ACQUISITION PROCESS) ---------- 63

APPENDIX D - (ENGINEERING CHANGE IMPLEMENTATION PROCEDURES FLOW DIAGRAM) ---------- 64

APPENDIX E - (NAVELEX CONFIGURATION (CHANGE) CONTROL PROCEDURES DIAGRAM) ---------- 67

LIST OF REFERENCES ---------- 69

INITIAL DISTRIBUTION LIST ---------- 71

LIST OF ABBREVIATIONS

ADP - Automated Data Processing

AE - Acquisition Engineer

AEL - Allowance Equipage List

AFP - Approval for Full Production

AM - Acquisition Manager

APA - Appropriations Purchase Account

ATE - Automatic Test Equipment

CCB - Configuration Control Board

CCRB - Configuration Control Review Board

CCSB - Configuration Control Sub-Board

COSAL - Consolidated Shipboard Allowance List

COSBAL - Consolidated Shore Based Allowance List

CNM - Chief of Naval Material

CNO - Chief of Naval Operations

DLSC - Defense Logistics Support Center

ECP - Engineering Change Proposal

FMA - Fleet Maintenance Activity

FMP - Fleet Modernization Program

FMS - Foreign Military Sales

HSC - Hardware Systems Command

ICP - Inventory Control Point

MDF - Master Data File

MRP - Maintenance Repair Part

NAVELEX - Naval Electronic Systems Command

NAVELEXDETMECH - Naval Electronic Systems Command Detachment, Mechanicsburg

NAVMAT - Naval Material Command

NAVSUP - Naval Supply Systems Command

NIIN - National Item Identification Number

NSF - Navy Stock Fund

NSN - National Stock Number

O&MN - Operations and Maintenance, Navy

OPN - Other Procurement, Navy

PME - Program Manager, Electronic

PPR - Planned Program Requirement

PSD - Program Support Data

PTD - Provisioning Technical Documentation

QA - Quality Assurance

RACC/ATS - Requirements Accumulator/Acquisition Tracking System

SECAS - Ship Equipment Configuration Accounting System

SCN - Shipbuilding and conversion, Navy

UICP - Uniform Inventory Control Program

WPN - Weapons Procurement, Navy

WSF - Weapons System File

I. INTRODUCTION

A. INTENT

The rapid rate of technological advancement in the field of electronics has generated special problems for the Navy's procurement and support of electronic equipment. One result of this rapid change is that many electronic equipments have several different models in service during the same time frame creating a myriad of support and configuration problems.

The intent of this thesis is to examine the factors that contribute to the existence of such equipment and to discuss the logistics support problems associated with multiple model equipment. It concentrates on Naval Electronic Systems Command (NAVELEX) managed equipment and on the difficulties experienced by the Ship's Parts Control Center's (SPCC) in providing operational parts support for this equipment. This thesis will also attempt to offer recommendations, where possible, to reduce the impact of the logistics support problems associated with multiple model electronic equipment on operating units.

This thesis specifically examines the reprocurement process at NAVELEX and SPCC and the field change procedure at NAVELEX as they relate to multiple model items. It attempts to determine the duties and responsibilities of each command and to highlight possible problem areas in the processes.

B. APPROACH

Analysis of ten years of NAVELEX historical demand data for the seven models in the R-1051 radio receiver series motivated this research effort. The analysis led to questions about the causes of multiple models and their affect on logistics support. The initial thrust of the research was to determine the nature of the interface that exists between NAVELEX and SPCC and to examine the responsibilities of each command for the procurement, support and maintenance of electronic equipment. This included a review of existing feedback mechanisms between NAVELEX and SPCC and the management of configuration changes in electronic equipment. The research was next directed toward an assessment of the impact of these changes on the logistics support of NAVELEX managed multiple model electronic equipment.

The research process consisted of reviewing applicable directives, instructions and other written meterial and interviewing people at NAVELEX headquarters, SPCC and the NAVELEX Detachment, Mechanicsburg (NAVELEXDETMECH), both via telephone and a personal visit.

C. DEFINITIONS

The following terms are defined as they are used in the context of this thesis.

1. System Hierarchy: A system is composed of sub-systems that can be broken down into components. These components

are made up of assemblies, sub-assemblies and piece parts. The AN/WRC-1 is an example of a sub-system of the communication system on a ship. The R-1051 radio receiver is a component of this sub-system and the MT-3114 shock mount is an assembly on the R-1051. The electronic equipment referred to in this thesis is at the component level but it should be noted that multiple models can exist at other levels in the hierarchy.

2. Maintenance Repair Parts (MRP): MRPs are considered to be assemblies, sub-assemblies or piece parts required in the maintenance or repair of a higher assembly or component.

3. Model: A model is one of the versions of an equipment, i.e., the R-1051A is the second model of the R-1051 radio receiver series. Equipment that has more than one model is referred to as a multiple model item in this thesis.

4. Reprocurement: In this thesis, reprocurement refers to the acquisition of additional quantities of equipment that is currently in service.

5. 2Z Cog Item: A 2Z cog item is a repairable item that is managed by NAVELEX.

D. ORGANIZATION

Chapter II will discuss the possible causes of multiple model electronic equipment and the logistics problems associated with them. Chapter III gives background information on NAVELEX, SPCC and NAVELEXDETMECH including their duties and

responsibilities and how they interface. Chapter IV discusses the reprocurement process at NAVELEX and SPCC and how it affects logistics support for multiple model electronic equipment. Chapter V deals with the field change process at NAVELEX. Chapter VI offers conclusions and recommendations for reducing the impact of the logistics support problems associated with multiple model equipment on operational units.

II. PROBLEM STATEMENT

A. REASONS FOR MULTIPLE MODELS

NAVELEX manages approximately 1200 electronic items, many of which have multiple models. These multiple models are items that are designed to perform the same basic functions and are part of the same system but for various reasons have different internal configurations. Each model is given a letter designation in its nomenclature and normally has a different stock number. An example is the R-1051, a radio receiver which is currently in its eighth version, designated as the R-1051G.

There are five basic factors that contribute to the existance of multiple models of an item. The first is that additional operational capabilities are desired for a particular equipment because operational requirements have changed, such as a need for a wider frequency band on a radio receiver. The second factor is that the equipment can no longer be supported; i.e., repair parts are no longer available or are very expensive to procure. The third is that problems have developed with the item while it is in service due to an initial design deficiency that can be corrected only by a design change. A fourth reason for multiple models is the lack of complete engineering technical data on models currently in service which leads to inadequate procurement specifications.

The fifth factor that may contribute to the existence of multiple model items is that the use of competitive contracting is mandated where feasible.

The requirement for improved performance may be the result of a desire for improved equipment reliability, improved performance, or to extend the functional capability of the equipment. These requirements for improved or additional capabilities often parallel technological advancement and the desire to have state-of-the-art equipment for use in the fleet.

In the case where equipment is no longer supportable, it is often due to technological obsolescence. The technology used in electronic component parts, i.e., circuit boards, semi-conductors, etc., changes rapidly and manufacturers will discontinue parts which contain obsolete technology because there is no longer a commercial market for them. If the equipment design requires parts that are no longer manufactured it becomes extremely difficult to support and repair. It may be more cost effective from a life cycle point of view to purchase an expensive new model incorporating current technology that is readily parts supportable rather than procuring obsolete parts to support older equipment.

When equipment has been in service for a period of time, design deficiencies or inadequacies are often revealed which must be corrected by making design changes to the equipment. If these changes are extensive enough, then a new model

designation is created. Changes to equipment which is in service are made through the field change process which will be discussed in detail in Chapter V. Requests for changes can be generated by end users, fleet maintenance activities or the manufacturer of the equipment. Once a change request has been approved, it usually takes several years to accomplish the change on all the equipment requiring it. Often the equipment which has received the field change modification will be designated with a new model number while the equipment which has not been modified will retain its original nomenclature. Because equipment may fill a variety of mission needs, some installations may not require and therefore not be authorized to receive a particular change and would retain the original model number and configuration.

The fourth and fifth factors that contribute to new models being introduced into service involves the reprocurement process and the lack of detailed technical data, both of which will be discussed in more detail in Chapter IV. When requirements for additional equipment are received, NAVELEX and SPCC are required by law to use a competitive form of procurement whenever possible in order to take advantage of the benefits of competition. This often results in a new manufacturer receiving the contract. NAVELEX also often uses improved performance specifications instead of detailed engineering specifications when reprocuring an item. This occurs because of the lack of detailed technical data or

because of a desire to take advantage of technological advancements. The combination of a new manufacturer and the use of performance specifications will often result in NAVELEX receiving a new equipment model which is interchangable with the older model but has a different internal configuration.

The next section of this chapter will discuss some of the problems and pressures put on the supply and maintenance systems in order to support multiple model items.

B. PROBLEMS RELATED TO MULTIPLE MODEL ITEMS

Numerous logistic support difficulties related to multiple models of items arise from the differences in configurations among models. Each model may require a different type of logistic support which puts additional strain on the supply and maintenance systems. Each model may require one or more of the following [Ref. 1:187]:

1. Different type and quantity of test and support equipment;
2. Different type and quantity of spare parts;
3. Different source for equipment and spare parts;
4. Different personnel training requirements especially in maintenance and repair procedures;
5. Different maintenance and repair procedures; or
6. Additional repair and spare parts procurement and storage.

When new models of electronic equipment are introduced into service, they regularly experience delays in maintenance

repair parts support. One extreme example of this was the R-1051G radio receiver. In 1979 a contract for the R-1051G was let by NAVELEX but parts support was not available until approximately two years after the first R-1051G was delivered to the Navy. The parts support problem was alleviated during these two years by cannibalizing new equipment coming off the production line to provide spare parts for equipment which was already in service.

Due to the configuration changes between models, the Automatic Test Equipment (ATE) used for the previous model may not be able to be used to test and trouble-shoot the new equipment. The configuration changes in the new model must be documented and the software for the ATE must be validated to insure that the ATE can be used. If the software for the ATE can not be changed to adapt it to the new model then either new ATE must be developed and procured or the new models of equipment must be operated and repaired without it.

A second problem related to the maintenance and operation of a new model of electronic equipment is the training of personnel. Organizational level personnel must be trained in the proper maintenance and operation of the new model if it is to perform the mission for which it was designed, therefore whenever a new model enters service, personnel must be retrained. For example, Naval Material Command (NAVMAT) policies require that "personnel responsible for repair of electronic assemblies must receive formal training in

miniature and/or microminiature repair; on the job training is not an acceptable criterion for certification" [Ref. 2:5].

Interchangeability is another important issue in the management of multiple model electronic equipment and is an important aspect of maintainability and logistic support. When one item can be removed and replaced with another without affecting equipment performance, the items are said to be interchangeable [Ref. 1:271]. To insure interchangeability, form, fit and function specifications are often used in procurement by NAVELEX and SPCC. Despite efforts to procure interchangeable models, because of their internal configuration and construction, they may not be. For example, one model may be designed to operate in conditions with temperatures up to 90 degrees F, while another model may be designed to perform properly only up to 75 degrees F. As long as the conditions call for operating at 75 degrees F or less, these models are interchangeable but above that temperature they are not [Ref. 3].

Identifying the interchangeability of items is an important part of the NAVELEX and SPCC interface. NAVELEX is responsible for informing SPCC of the interchangeability relationships of equipment for which they have technical responsibility. This interface will be addressed later in this thesis.

Another problem experienced by NAVELEX is unplanned requirements for the new model of a multiple model item. Because of funding restrictions NAVELEX procures items based on planned requirements only and therefore must meet unplanned

requirements by using programmed assets. Satisfying unplanned requirements by borrowing from planned requirements can seriously jeopardize the completion of those programs for which the equipment was purchased. NAVELEX must then find other sources such as cannibalization, repair of an older model of the equipment or the cancellation of other planned requirements to fill the programmed needs [Ref. 4:33].

C. SUMMARY

Multiple models of items can create many logistics support problems. NAVELEX and SPCC must overcome these difficulties in order to provide the operational units with mission essential electronic equipment which can perform the functions for which it was designed and also be supported with the required repair parts and test equipment.

III. BACKGROUND

A. NAVELEX

NAVELEX is a Hardware Systems Command (HSC) and as such is responsible for the planning, development, programming, acquisition, installation, logistics, technical support and guidance for particular classes of electronic equipment and systems to support Naval operations throughout the life cycle of the equipment [Ref. 5:5].

The Chief of Naval Operations (CNO) has categorized material into two basic groups, principal items and secondary items.

Principal items have the following characteristics [Ref. 4:20]:

1. The cognizant HSC determines requirements on a planned basis.
2. The requirements are based solely on planned end-use allowances and planned reserve/retention requirements.
3. Budget formulation for each item is done separately by Material Planning Studies and Principal Item Stratifications.
4. Appropriated investment funds are used to procure the items.
5. Attrition is based solely on major or total destruction, intended destructive use or planned retirement.

6. The issue to end-use is limited to HSC established allowance or to HSC-approved special authorization.

Secondary items as defined by the CNO have the following characteristics [Ref. 4:20]:

1. The cognizant ICP determines requirements.
2. The requirements are based on observed or estimated demands or on non-demand based insurance levels.
3. The budget is formulated based on standard levels-setting techniques and standard item stratification projections.
4. Stock funds are used for item procurement.
5. Attrition is based on consumption or normal in-service wearout.
6. Issues to end-use can be subject to limitation of established allowances but are normally only limited by quantitative validation.

It is important to emphasize the major differences in the two classifications because NAVELEX manages end items which include both principal and secondary items but are funded based on the assumption that all the items they manage exhibit principal item characteristics. The three differences to be stressed here are the way in which requirements are set, how attrition occurs and what types of funds are obtained for each category of item.

Requirements for principal items are justified on a planned basis for a specified total end-use population. No allowances

are made for unplanned demands. Secondary item requirements on the other hand do include unplanned demands. Principal items are funded through appropriations such as Shipbuilding and Conversion, Navy (SCN), Other Procurement, Navy (OPN) or Weapons Procurement, Navy (WPN) which are designated for a specified quantity of a specific electronic system or equipment. NAVELEX is funded for repair of principal items through Operations and Maintenance, Navy (O&MN). Secondary items are predominantly managed by SPCC and both repair and reprocurement are funded through the Navy Stock Fund (NSF).

NAVELEX also manages most of the secondary items which are components of the principal items they manage [Ref. 6:16]. Demand data for these NAVELEX managed items shows that many experience random or unplanned requirements. Most of these multiple model items are, in fact, secondary items which are repairable. Part of the unplanned demands can be attributed to the normal attrition of repairable items which is due to [Ref. 6:14]:

1. Failure or damage during use or repair to such an extent that subsequent repair is not possible;
2. No longer economical to repair;
3. Damaged or destroyed in transit between the repair facility and the user.

Unfortunately, NAVELEX does not receive funds to procure replacements for unrepairable electronic equipment. It is only level funded for performing repairs [Ref. 4:33]. Since

NAVELEX can not satisfy unplanned and unfunded requirements by procuring replacement equipment, it has to resort to the other sources of supply that were discussed in the previous chapter. Navy policy does allow NAVELEX to procure one spare for a principal item with fifty or less planned requirements and two spares for a principal item with more than fifty planned requirements [Ref. 7]. These are installation and check out spares whose purpose is to prevent shipyard delays and not to meet unplanned requirements. The Chief of Naval Operations can also approve the use of OPN funds to cover pipeline attrition of principal items but it must be obtained on an exception basis. The only way to correct the problem of unfunded, unplanned requirements is to change the manner in which NAVELEX is funded or to transfer management of items that exhibit secondary item characteristics to SPCC which, as an Inventory Control Point (ICP), is funded and uses inventory models which are designed to procure material to fill unplanned requirements.

The transfer of items to SPCC is handled through the Stock Coordination Program [Ref. 8]. It is the Navy's policy that there be only one inventory manager for each item in the Navy Supply System and that normally the inventory manager will be an ICP. There are four criteria by which a HSC can retain control of an item:

1. The item is in a research and development stage;
2. The item requires engineering control decisions;

3. The item is unstable in design;

4. The item is expressly assigned to a single command management by a separate authorizing NAVMAT directive.

For detailed description of each criteria see Appendix A.

A detailed discussion of the Stock Coordination Program is not within the scope of this thesis, but it is important to note that NAVELEX often retains control over multiple model items because they are considered by NAVELEX to be unstable in design.

Even when NAVELEX transfers an item to SPCC, its responsibilities for technical item control and design control are not abrogated. Many of NAVELEX's technical and design control responsibilities are carried out by the Naval Electronic Systems Command Detachment, Mechanicsburg (NAVELEXDETMECH) which is located at SPCC and is the topic of the next section.

B. NAVELEXDETMECH

NAVELEXDETMECH is a representative of NAVELEX and furnishes engineering and technical services to SPCC for NAVELEX cognizant equipment (2Z cog) and for SPCC managed equipment over which NAVELEX has technical and design control. The most important missions of NAVELEXDETMECH for the purpose of this discussion are that they are responsible for providing the engineering and technical support required by SPCC in the latter's efforts to provide for maintenance repair parts support of NAVELEX managed equipment. They also review

and/or generate Provisioning Technical Documentation (PTD) and furnish other support data to SPCC.

The Joint SPCC/NAVELEXDETMECH Internal Instruction 4355.8 provides a more detailed description of NAVELEXDETMECH's responsibilities and duties in providing support to SPCC. Those which are discussed below relate to multiple model item support [Ref. 9].

The detachment provides SPCC with technical data packages which are used to develop procurement data packages for repair parts procurement for 2Z items. The information must be accurate and be for the desired model to be supported if the item has multiple models.

The detachment also reviews SPCC contracts for items over which NAVELEX has technical responsibility as part of the quality assurance (QA) process. The review does not occur until after the contract is awarded. If a technical discrepancy is discovered that must be corrected, then a contract modification is required. Due to manpower constraints, NAVELEXDETMECH is unable to review all SPCC contracts for items over which NAVELEX has technical control.

The detachment also provides SPCC with engineering expertise for MRP support of 2Z items. This includes assistance in locating alternate sources for MRPs that are no longer obtainable from the original equipment manufacturer. This assistance is very important when SPCC attempts to procure repair parts for older models of multiple model items.

Because the electronics industry is changing rapidly, the support of older models of electronic equipment, which require obsolete repair parts, is difficult. Any procurement problem that can not be solved at NAVELEXDETMECH must be forwarded to NAVELEX.

Another important function that the NAVELEXDETMECH performs to assist SPCC is Allowance Parts List (APL) reviews and rewrites. Each model of a multiple model item has its own APL and these must be reviewed and updated to reflect parts and maintenance philosophy changes. The request sent by NAVELEXDETMECH to SPCC for an APL update is a key feedback method to notify SPCC and MRP support for a new model, or for an old model that has been modified, is required. The APL is used by SPCC to determine which parts are contained in an equipment so that MRP procurement documents can be generated. Therefore it is important that APL reviews be conducted whenever APL adequacy is suspect.

NAVELEXDETMECH has the capacity for completely rewriting only approximately 150 APLs per year. NAVELEXDETMECH must therefore review all NAVELEX APLs and select those that are most in need of rewrite.

APLs are rewritten based on requests by outside activities and known support problems. The detachment is often in the position of having to make APL rewrite decisions based on complaints from operating units and must therefore find accurate sources of information.

One of the best sources of information for older models of equipment are the Fleet Maintenance Activities (FMA). They are aware of maintenance problems and of changes that have been made in the equipment that may be causing support problems. configuration change data is also important in APL rewrites and may be obtained through field changes and Configuration Control Board reports which will be discussed in Chapter V. Another important source of information for NAVELEXDETMECH are Fleet Consolidated Shipboard Allowance List (COSAL) Feedback Reports (S/N 0190-LF-068-7100) sent by operating units which are experiencing COSAL technical problems.

It is important that some type of interim assistance be provided to the fleet since APL rewrites take months to complete. The notification of change is handled through a monthly COSAL update letter promulgated by SPCC. The NAVELEXDETMECH is responsible for sending a letter to SPCC informing them of any significant allowance changes, revisions in parts or changes in maintenance philosophy and for requesting that the information be included in the next COSAL update letter which is sent to operating units.

The NAVELEXDETMECH performs an important interface function between NAVELEX and SPCC. As has been noted, the proper performance of this function can impact heavily on SPCC's ability to provide support to the fleet for electronic equipment which has multiple models.

C. SPCC

SPCC is an Inventory Control Point (ICP) and has been tasked by the Naval Supply Systems Command (NAVSUP) to provide program support for NAVELEX systems, equipments, components and material for which SPCC is assigned inventory control or supply support responsibilities [Ref. 10]. As a consequence, SPCC provides cataloging functions, maintains APLs and COSALs, provides spare and repair parts program replenishments, Automated Data Processing (ADP) support and file maintenance as required by NAVELEX. Other functions are performed by SPCC for NAVELEX, but those listed above are impacted most heavily by multiple model equipment.

In providing cataloging functions for NAVELEX, SPCC has several specific duties. Upon request from NAVELEX, SPCC prepares and forwards item description data for 2Z cognizant equipment to the Defense Logistics Service Center (DLSC) for National Item Identification Number (NIIN) assignment. When a new model of a multiple item is procured by NAVELEX it may be assigned a cognizant code of 2Z even before it goes through the DLSC screen and the provisioning process at SPCC. This insures that NAVELEX will provide management control over the new model for an initial period of time [Ref. 4:19]. As part of SPCC's cataloging function, they also provide file maintenance and ADP support for NAVELEX controlled equipment. This includes the update, storage and retrieval of technical and supply management data.

SPCC also maintains NAVELEX inventory balances by location in the Master Data File (MDF) and the equipment characteristics in the Weapons System File (WSF) and MDF. Having up-to-date technical data on file is especially important for multiple model items. When changes are made to the internal configuration of an item, NAVELEX is responsible for providing SPCC with this data so that the appropriate files can be updated. If accurate technical data is not on file, then SPCC's ability to procure suitable repair parts and to support NAVELEX's repair program is seriously affected.

SPCC is also responsible for updating Allowance Equipage Lists (AEL), APLs, COSALs, and Consolidated Shore Based Allowance Lists (COSBAL) files. NAVELEX requests SPCC to update APLs after they have conducted a review and rewrite. This function is extremely important because APL updates are used by SPCC to determine which repair parts to procure and which ones to stop procuring. If APLs are not updated properly, SPCC will continue to maintain stocks of obsolete parts while not procuring new repair parts and spares. Multiple model items cause unique problems for SPCC in maintaining accurate COSALs and COSBALs. When an operating unit replaces one model of a multiple model item with a different model, that unit's COSAL or COSBAL must be updated to reflect the change. Unless SPCC is notified of the change, the operating unit will not carry the proper repair parts.

The Ship Equipment Configuration Accounting System (SECAS) is the current method by which shipboard equipment configuration is reviewed and documented and by which SPCC is notified of a change. Under SECAS, equipment validation is conducted during overhaul periods. Since ships now go through overhaul every five years, it is important that the operating unit notify SPCC of any changes in shipboard electronic equipment configuration that occur between overhauls. At the present time it is the operational unit's responsibility to request COSAL updates via the OPNAV 4790/CK Configuration Control Form as changes occur. This form is used by SPCC to update the Weapons System File (WSF) which contains shipboard equipment configuration information.

Providing MRP support for NAVELEX managed items is another duty with which SPCC has been tasked by NAVSUP. Approximately 85 percent of the parts required to support 2Z cog items are managed by the Defense Logistics Agency (DLA), with the remainder being managed by SPCC [Ref. 3]. SPCC is responsible for arranging supply support from other ICPs having cognizance of items required for the maintenance and operation of NAVELEX electronic equipment.

Replenishment of repair parts, controlled by SPCC and used to support NAVELEX items, is based on failure rates and population data. As has been stated earlier, the only formal method by which SPCC is notified of a change in the repair parts requirements for 2Z cog items is through the APL review

and update process. It is NAVELEX's responsibility to request APL updates as well as updating the technical data for all material procured by SPCC to support 2Z cog items. The item managers at SPCC are notified via the Uniform Inventory Control Program (UICP) when and how many repair parts to procure. If a technical review is needed, SPCC uses the technical data on file to verify the item and they assume that NAVELEX has updated the technical package as required [Ref. 5:25].

Parts support for older models of multiple model 2Z items is a special problem for SPCC and NAVELEX. There is no formal feedback to SPCC from NAVELEX to let them know that an item has reached the end of its useful service life and that the population of the item is declining. Even though equipment or a particular model of equipment is being phased out of service there is a need to support the equipment still in use because it will normally take years to remove it all from service.

A special reclamation program has been tested with the WLR-1 and the WLR-6 to provide the necessary parts support for equipment being phased out of service. A contractor received the WLR-1s when they were removed from operational units and stored and repaired them as required. When SPCC received a requirement for a repair part for a WLR-1 they contacted the contractor who would issue the part. The system worked well but was expensive. The reclamation program was also used with the WLR-6 except that FMA Norfolk was tasked

with receiving, storing and issuing repair parts to customers when requested to do so by SPCC. Due to a lack of funds, personnel and facilities, the WLR-6 program did not work as well as the WLR-1 program. The FMA was not able to maintain accurate inventory records or the condition of the material in storage [Ref. 11].

NAVMAT INSTRUCTION 4790, currently in draft form, addresses the reclamation program and assigns responsibilities for carrying out the program. The instruction calls for the removal, storage, and repair when necessary of equipment being replaced by new acquisition equipment. The reclamation program may be the most cost effective means of providing material support to equipment being phased out of fleet use and is therefore being continued despite the problems with the WLR-6 project [Ref. 2].

The feedback of technical and configuration data from NAVELEX to SPCC is very important if SPCC is to be able to meet the requirements placed upon it to support NAVELEX managed multiple model items. One factor that effects the interface between NAVELEX and SPCC is based upon their respective missions and the criteria by which each is evaluated. The Fleet and NAVMAT evaluate NAVELEX on how well the equipment or system which they have developed performs the fucntions for which it was designed and how maintainable it is. NAVELEX must also work within budgetary constraints when designing electronic equipment. SPCC, on the other hand, is

evaluated by NAVMAT and the Fleet on the timeliness of parts support to operational units and on how well they conform to acquisition regulations [Ref. 5:59]. As a result of these different evaluation criteria, NAVELEX and SPCC will take actions with respect to the items which each controls that will reflect most favorably on them. These actions at times may be divergent, especially in the area of reprocurement of electronic equipment. NAVELEX is concerned with providing operating units with up-to-date reliable electronic equipment which often requires additional logistics support. This creates difficulties for SPCC in providing adequate and timely maintenance repair parts support to operating units. The NAVELEX reprocurement process is one of the topics addressed in the next chapter.

D. SUMMARY

The feedback mechanisms between NAVELEX, SPCC and the operating units influence how well multiple model electronic equipment is supported. It is imperative that SPCC be notified in a timely manner of internal configuration changes to electronic equipment and to changes in the configuration of electronic equipment at the operating unit. Without internal electronic equipment configuration change information, SPCC can not procure the proper MRPs. Without such information SPCC can not maintain updated COSALs and COSBALs.

IV. REPROCUREMENT PROCESS

The purpose of this chapter is to describe the process by which NAVELEX procures additional quantities of an electronic item that is currently in service but for which new requirements have developed. The interface between NAVELEX and SPCC is also examined, emphasizing the supply support requirements for new models of electronic equipment, which has been transferred to its control from NAVELEX, is the topic of the second section of this chapter.

A. NAVELEX REPROCUREMENT

NAVELEX procures additional quantities of electronic systems and components that are currently in service use based on planned programmed requirements (PPR). These PPRs are generated by several sources including new ships construction, the fleet modernization program (FMP), foreign military sales (FMS) or other programs [Ref. 12]. An excellent example of an item being reprocured many times is the R-1051 radio receiver, which was discussed in Chapter II. This radio receiver has been in use with all the services and many foreign countries since 1965 and is currently being reprocured by NAVELEX.

The Requirements Accumulator/Acquisition Tracking System (RACC/ATS) is used to compile electronic systems and components requirements. RACC/ATS is part of the NAVELEX information system and is supported by the central computer at SPCC, with

remote on-line terminals located at NAVELEX [Ref. 5:36]. The project managers at NAVELEX load requirements into the system by nomenclature, ship, quantity, and required delivery dates. RACC/ATS examines the current assets of an item including not-ready-for-issue (NRFI) carcasses and generates a buy quantity based on planned requirements if there are not enough assets on hand to meet the requirements. All buy quantities produced by RACC/ATS are manually checked by the inventory managers before a procurement request is prepared by the Requirements Division. The technical package for the equipment is then prepared by the project engineer, and forwarded to the contracts division for review and selection of the method of procurement to be used.

There are two basic methods of procurement which NAVELEX can use, formal advertising and negotiation. Formal advertising must be used whenever it is feasible and practicable under existing conditions and circumstances. When formal advertising is not feasible and practicable, negotiation may be used under any one of the seventeen exceptions cited in the Defense Acquisition Regulations (DAR). A detailed discussion of contracting methods is not within the scope of this thesis but it should be noted that it is Government policy that all procurements, whether by formal advertising or by negotiation, shall be made on a competative basis to the maximum practicable extent [Ref. 13:1-20].

As has been noted before, NAVELEX often uses improved performance specifications when reprocuring an item because of a lack of complete technical data, a desire or need for better performance, or a desire to take advantage of technological advancements in the field of electronics [Ref. 14]. The lack of complete technical data is frequently due to the fact that it is not purchased from the original equipment manufacturer at the time of initial procurement. The manufacturer is often unwilling to sell the data to the Navy because of a fear that other competitive companies will have access to the data. It is also expensive to maintain technical data because of the rapidly changing nature of the electronics industry. "Acquiring, maintaining, storing, retrieving, and distributing technical data in vast quantities generated by modern technology is costly and burden-some for the Government. For this reason alone, it would be necessary to control closely the extent and nature of data procurement" [Ref. 13].

The use of other than complete design specification when reprocuring electronic equipment gives the contractor leeway when designing the equipment and in the selection of the technology to be used. This can provide operational units with equipment that contains current technology but it also virtually assures that the design used by the contractor will not be the same as the design of the equipment already in service. As noted earlier, this is one of the major factors contributing to multiple model items being used in the Navy.

1. Approval for Full Production Procedures

When electronic equipment is to be reprocured by NAVELEX and there are "significant" changes made in the original design, the new model must receive Approval for Full Production (AFP) before the contract is awarded. The AFP procedures have recently been revised and are currently in a state of flux [Ref. 15]. OPNAVINST 5000.42B of 20 August 1983 provides the format to be followed for AFP procedures but does not provide a detailed definition of a "significant" change. In NAVELEXINST 3960.3B of 20 January 1983, a significant change is defined as any alteration of hardware that results in:

a. 33 percent or more change in internal parts;
b. New formal training required for maintenance and operation;
c. 33 percent or more changes in manuals; or
d. Change in AN nomenclature. (AN is a set designation in electronic equipment nomenclature, i.e., the AN/WRC-1 is a radio set.)

NAVELEX has further reduced the number of internal components changed to 25 percent to qualify an item to be processed through the AFP procedures [Ref. 14].

New models of multiple model items which are controlled by NAVELEX must go through the AFP procedures. The level of AFP approval for an equipment or system is based on its acquisition category. Acquisition category I requires DOD

level approval and includes equipment with more than $200 million in Research and Development (R&D) costs or a life cycle cost of more than one billion dollars. Acquisition category II items have less than $200 million in R&D costs but more than $100 million in R&D costs or a life cycle cost of more than $500 million but less than one billion dollars and is broken down into sub-categories IIs and IIc. Category IIs requires Secretary of the Navy approval while IIc requires Chief of Naval Operations (CNO) approval. Acquisition categories III and IV have less than $100 million in R&D costs and $500 million in life cycle costs. Acquisition category III is approved by the program sponsor and is defined as a system that has "intercourse" with the enemy, i.e., directly affects the Navy's combat capability. Acquisition category IV includes equipment that does not directly affect the Navy's combat capability. Approval authority for this category rests with the Chief of Naval Material (CNM). CNM has delegated approval authority to the system commands for category IV items which have been further split into categories IVt and IVm. Acquisition category IVt requires an operational evaluation while IVm requires no operational evaluation [Ref. 15].

2. Provisioning Guidance Conferences

After AFP has been received, it is important for logistics purposes that SPCC be notified of the new or additional MRP required to support the new model of electronic equipment. The key feedback mechanism designed to notify

SPCC to provide adequate and timely positioning of MRPs for new models of electronic equipment is the Provisioning Guidance Conference. At that conference, SPCC is provided with Provisioning Technical Documentation (PTD), Program Support Data (PSD) and the Provisioning Requirements Statement (PRS) [Ref. 14]. The purpose of the conference is to establish provisioning milestones to ensure that supply support is available when the initial hardware delivery is made. This is an effort to preclude the necessity of diverting end items for cannibalization to support the new models (as was described in Chapter II) and to have MRP support available when the new model enters service. The Provisioning Guidance Conference is normally held before the reprocurement contract is awarded with specific provisioning data being developed at the time of award. Despite these efforts, the Conference, is at times, held after the contract is awarded. As an example, NAVELEX awarded a multi-year contract to Stewart-Warner Electronics of Chicago for a new version of the AN/URT-23 radio transmitter set and a new model of the R-1051 radio receiver. The contract was awarded on 30 September 1983 but the Provisioning Guidance Conference was not held until 25 October 1983. This delay could impact on SPCC's ability to have MRP support available in November 1985 when the initial hardware delivery is to occur [Ref. 16].

3. Timing of MRP Availability

NAVELEX Instruction 4400.9 of 4 August 1983 provides policy for the planning and budgeting of the initial supply support for NAVELEX cognizant equipment. The scope of the instruction is "applicable to all acquisitions for electronic equipment procured under the authority of NAVELEXSYSCOM" [Ref. 17] but it specifically addresses only initial provisioning of new equipment. The instruction directs that MRP support should be available when the equipment reaches its initial operational capability (IOC) date. Appendix B shows the provisioning process in the form of a time line of the budget lead time for MRPs. As can be seen, MRP support is scheduled to be delivered at the time of the equipment's IOC. A similar instruction establishing supply support policy for new models of multiple model items would be helpful in highlighting that these items face the same MRP support problems as new electronic equipment.

Enclosure (1) of NAVELEXINST 4400.9 states that an option is to be included in the hardware acquisition contract which allows SPCC to place orders for MRP under the same contract. If this option could be included in NAVELEX contracts for new models of multiple model items then it may be possible to avoid some of the delay in supply support for the new models. It could also help to eliminate the necessity of cannibalizing end items in order to provide MRPs.

B. REPLENISHMENT BUYS FOR ELECTRONIC EQUIPMENT BY SPCC

SPCC may be required to reprocure electronic equipment that has been transferred to their control from NAVELEX by the Stock Coordination Process. When the item is transferred it changes from a 2Z cog designation to a 7G cog designation. However, NAVELEX retains technical and design control responsibilities. The majority of items transferred from NAVELEX to SPCC are inactive (approximately 75 percent) and do not require replenishment buys to be made by SPCC [Ref. 3].

When an item is transferred by NAVELEX, it is NAVELEX's responsibility to furnish SPCC with copies of contracts and modifications that may impact SPCC reprocurement contracting at the time the item is transferred. SPCC assumes that the technical data received at the time of transfer is correct and up-to-date [Ref. 5:27].

1. Family Relationships

SPCC replenishment buys for multiple model electronic equipment are based on family relationships and are normally for the head of the family because all demand is aggregated and accumulated against the family head. The head of the family is defined as the preferred item of the family and is generally the latest model of the equipment. Family-related equipment refers to items that share common applications in higher assemblies or systems and are substitutable for each other to some degree [Ref. 18:7-1]. Family relationship determination for multiple model items is difficult for SPCC.

Information on interchangability and substitutability is often not available at SPCC and can not be supplied by NAVELEX engineers. At times this has made it difficult for SPCC to procure the desired equipment model [Ref. 3]. A new system called Interchangable/Substitutable Item System (ISIS) is being developed and is intended to provide the family relationship information required by SPCC to make replenishment buys for multiple model items. It is a joint services project and is scheduled for implementation by the Navy in FY 85.

2. Acquisition Process

Appendix C shows the 7G acquisition process at SPCC. The technical data which is available to SPCC determines the type of specifications which SPCC can use to reprocure the item. If NAVELEX has provided top down data and drawings, then SPCC can reprocure using design specifications and can be assured of receiving an identical item. If detailed technical data is not available, then SPCC must use form, fit and function specifications and may receive a different item. If the item is significantly changed, then it will be processed through the DLSC screen, receive a new stock number, a new model designation, and go through SPCC's provisioning process to determine MRP support requirements. If the change results in improved capabilities, then the new model becomes the head of the family [Ref. 3].

SPCC has the same problems of maintaining complete technical data on electronic equipment as NAVELEX. The only

way to ensure that the same electronic equipment will be produced by the contractor is to provide him with detailed design specifications. The major advantage of SPCC having detailed technical data is that it helps to avoid the logistic problems associated with multiple model items. Some of the disadvantages associated with maintaining complete technical data on all the electronic equipment managed by SPCC are [Ref. 5:52]:

a. Data purchased during the initial buy will be obsolete when reprocurement is made;

b. Data must be continually reviewed and updated which requires an expenditure of a great deal of manpower;

c. Some manufacturers are reluctant to sell complete technical data for fear of losing it to competition;

d. The Defense Acquisition Regulations states that the Government should not buy more technical data than it needs.

For these and possibly other reasons SPCC is not able to maintain complete technical data on all of the thousands of electronic items that they manage.

Changes to electronic equipment design that occur during the procurement process are accounted for as Engineering Change Proposals (ECP). There are two classes of change proposals, I and III. MIL-STD-480 contains definitions for the two classes of ECPs. A class I ECP is a change in the

functional configuration, product configuration identification, technical requirements as contractually specified, non-technical contractural provisions or other factors that affect the operation or maintenance of the item. A class II ECP is a change that does not fall within the definition of a class I ECP. Examples of a class II change are a correction of errors in documentation, addition of clarifying notes or the substitution of alternate material that does not affect the performance, operation, or maintenance of the item [Ref. 5:44]. SPCC has the authority to approve class II change requests received from the contractor. They are reviewed and approved by the technical division at SPCC. All class I ECP requests must be sent to NAVELEX for review. The change is then approved or disapproved by the Configuration Control Board at NAVELEX. The functioning of this board will be discussed in the next chapter.

The 7G item manager at SPCC recommends replenishment buys based on the inventory models contained in the UICP. This program assumes that the same item will be reprocured during each replenishment buy and calculates replenishment quantities based on projected demands, order costs, procurement lead times, carrying costs and stockout costs. As has been noted above, this is seldom the case with multiple model electronic equipment. The rapid state of technological change in the electronics industry and the lack of detailed technical data at SPCC make it very difficult to assume that the next

replenishment buy for an electronic item will be the same as the current one. With electronic equipment becoming "obsolete" with each new replenishment it may be practical for SPCC to adopt an optimal final inventory model that will consider this obsolescence. Hadley and Whitin have developed such a model [Ref. 19:454]. The model is designed to minimize the liquidation costs of the item, inventory carrying costs, and stock-out costs. The model assumes that the obsolescence date of the item is a descrete random variable and that the demand for the item has a Poisson distribution for a given time to obsolescence.

The scope and intent of this thesis does not allow a detailed examination of the inventory models in use at SPCC or the optimal final inventory model. It is appropriate, however, to point out that multiple model electronic equipment may not exhibit the characteristics for which the current inventory models were designed and that it may be possible to develop models which incorporate the rapid obsolescence of electronic equipment.

C. SUMMARY

This chapter has examined the reprocurement processes at both NAVELEX and SPCC and has noted that new models of electronic equipment are often the result. These changes can be attributed to a variety of reasons; most significantly being to insure state of the art equipment for fleet use. It is also possible for changes to be made to electronic

equipment which is in service that cause it to be designated as a new model. These changes are accomplished by the field change process, which is the subject of the next chapter.

V. FIELD CHANGES

This chapter examines the field change (FC) process for electronic equipment as managed by NAVELEX. As was noted in Chapter III, field changes are one cause of multiple models in electronic equipment. This chapter will discuss configuration control, the field change Implementation Program at NAVELEX, and the SPCC/NAVELEX feedback mechanism for providing logistics support for items that have received Field Changes.

A. CONFIGURATION CONTROL

Configuration control is the systematic evaluation, coordination, approval or disapproval, and the subsequent implementation of approved changes in the configuration of electronic equipment whose configuration has been formally approved [Ref. 20:b-2]. Configuration control is important because it has a large impact on the technical data package and MRP support required for electronic equipment. The five goals of configuration control are [Ref. 5:40]:

1. Definition of all the documentation required for product fabrication and testing;
2. Complete and correct description of the approved configuration;
3. The traceability of an item and its parts to their approved configuration;

4. Complete and accurate identification of all material, parts, subassemblies and assemblies that make up an item; and
5. Complete and accurate evaluation, control and accounting of all changes to an item and the item's documentation.

Configuration control for changes to electronic equipment for which NAVELEX has technical and design responsibility is implemented through the field change process.

B. FIELD CHANGE PROCESS

A field change may be defined as any authorized alteration or modification made to an electronic equipment after it has been delivered to the Navy [Ref. 20:B-5]. Field changes are developed when they are required to correct deficiencies, make an effectiveness change in operational or logistics support requirements, or provide substantial life cycle cost savings [Ref. 21:1].

Field changes are normally the results of approved ECPs. An ECP is the documentation by which a change to electronic equipment is described and suggested and includes both preliminary and formal ECPs. A preliminary ECP is submitted to the Navy for review prior to the availability of the documentation to support a formal ECP. A formal ECP provides engineering and cost data in sufficient detail to support formal change approval and contractual authorization [Ref. 21:2].

Many causes can lead to an ECP for electronic equipment, but most often they are based on user experience. Complaints from users can lead the FMAs, the Mobility Training Units (MOTU), the manufacturer or the users themselves to generate an ECP.

All ECPs, other than class II ECPs for which approval authority has been delegated, must be processed through the NAVELEX Engineering Change procedures. If the ECP is approved it will result in a modification to a contract for items currently in production or a FC for equipment already in service with operational units [Ref. 22]. Appendix D shows the Engineering Change implementation process for NAVELEX.

After an ECP has been developed it is submitted to the NAVELEX Configuration Management Branch (ELEX 8123) or to the cognizant Project Manager (PME) where a technical evaluation of the ECP is conducted. The ECP is then forwarded with disposition comments and recommendations to the appropriate Configuration Control Board (CCB).

CCBs and Sub-Boards (CCSB) are official agencies within NAVELEX headquarters that act on all aspects of ECP approval or disapproval [Ref. 20:4-1]. A CCB is composed of representatives from the program functional areas for the equipment being reviewed such as engineering, configuration management, contracts and logistics support.

Appendix E shows the configuration control procedures by which NAVELEX CCBs approve or disapprove ECPs. The CCB takes

into consideration all aspects of the changes to the electronic equipment when evaluating an ECP. Those aspects include, but are not limited to, design, safety, performance effectiveness, logistics support and training. All supporting data required for evaluating an ECP must be made available to the applicable CCB before approval can be granted. Final approval of an ECP by the CCB is based on a review of all comments and recommendations, performance versus life cycle cost changes, effects of the change on operational readiness and the availability of funding [Ref. 20:4-3]. The approval of an ECP is promulgated by a CCB Directive which contains the authority to implement the change in the form of a Field Change for electronic equipment that is in service or a contract modification for an item under procurement.

Once an engineering change has been approved as a FC, it can be accomplished under the NAVELEX Field Change Installation Project (FCIP), or by shipyards and FMAs, or by organizational personnel at the option of the appropriate Type Commander. The FCIP is a NAVELEX project designed to complete the installation and certification of FCs for installed NAVELEX cognizant equipment and systems in the fleet. Special electronic installation teams from the field activities perform the work and are responsible for procuring the required material, updating technical documentation and reporting the completion of the installation. The FCIP concept was developed to ensure

the completion and documentation of unaccomplished FCs on electronic equipment in the active fleet ships [Ref. 21:9].

Field change kits are used in the installation of a FC. The kits contain the documentation and parts required to complete the FC. According to NAVELEX policy, FC kits will be staged at either of the Naval Electronic Systems Engineering Centers in San Diego or Charleston in the required quantities for distribution to the appropriate activity, or they will be shipped directly to the special installation teams which are designated to perform the installation. The FC kits are not issued to ships without Type Commander approval because NAVELEX procures only enough FC kits to complete the change on a designated number of equipments [Ref. 21:2].

When a FC to an electronic equipment has been completed it will normally be designated with a new model number if the change was significant. SPCC must be notified of the change and must now provide MRP support to two models of electronic equipment because all the installed equipments are not changed at once. Providing accurate and timely feedback to SPCC concerning FCs and their installation schedules is one of the major problems of the field change process.

C. FIELD CHANGE PROBLEMS

There are several problems related to the FC process. One of the most serious is the lack of centralized control for FCs at NAVELEX. Despite the fact that NAVELEX policy requires that all ECPs be submitted to ELEX 8123 for centralized

administrative control, many still go directly to the PMEs and it is their responsibility to inform ELEX 8123 [Ref. 21:3]. NAVELEX Instruction 4720.5 directs that all ECPs be processed by ELEX 8123 while Appendix D, taken from the NAVELEX Engineering Change Implementation Procedures Handbook, shows that ECPs can be submitted to either ELEX 8123 or the appropriate PME. Without centralized processing of ECPs at NAVELEX there is no way for ELEX 8123 to ensure that NAVELEXDETMECH and SPCC are notified of all engineering changes to NAVELEX managed electronic equipment.

There is also a lack of centralized control over the distribution of CCB Directives at NAVELEX. NAVELEX procedures again direct that a copy of all CCB Directives will be provided to ELEX 8123 [Ref. 20:4-4]. Because ELEX 8123 does not receive all ECPs, they have no way of knowing what CCBs have met and which Directives they should have in their Master File. ELEX 8123 forwards copies of all the CCB Directives that they process, or that are sent to them by the PMEs, to SPCC [Ref. 22]. If SPCC does not receive copies of the CCB Directives, it is difficult for them to find out that new or additional MRP support is required.

Another consequence of the lack of proper distriubtion of CCB Directives is that NAVELEXDETMECH must resort to reviewing Electronic Information Bulletins (EIBs) in order to obtain notification of engineering changes to NAVELEX managed equipment. The EIB is a biweekly publication of the Naval Sea

Systems Command which is distributed to Naval forces afloat and to shore activities to provide them with electrical and electronic information. Without notification of the engineering changes, NAVELEXDETMECH can not carry out the reviews of the engineering changes that are part of their mission.

During their review of an engineering change, the NAVELEXDETMECH determines [Ref. 11]:

1. MRP requirements;
2. Which equipments the engineering change affects, i.e., will it affect all models or just certain applications; and
3. Which APLs need to be rewritten and request SPCC to update them.

When NAVELEXDETMECH is not notified of an engineering change, then it is most likely that SPCC will not be informed. When SPCC is not notified of an engineering change, they can not provide adequate and timely MRP support for the models of electronic equipment that have received the FC. SPCC must also be informed as to which operating units have equipment that has received the FC so that the units' COSALs or COSBALs can be updated as required. Without feedback from NAVELEX, SPCC must rely on notification by the operating units when a FC has been made in order to perform the required updates.

Another problem of the FC process is the length of time it takes to implement a FC in all the equipments that require it. Once a FC has been approved it normally takes two years for

NAVELEX to receive funding and another year to procure the FC kits. After the kits are on hand it normally takes two to three years to install them because of the policy of installing FCs during overhauls whenever possible. This results in a five to six year delay from the identification of a problem until all of the changes are made which is a concern of NAVELEX [Ref. 22]. The long installation time frame also causes the need for SPCC to be continually updating COSALs and COSBALs and it also requires operating unit personnel be trained in the operation and maintenance of two models of equipment.

D. SUMMARY

NAVELEX, SPCC, and NAVELEXDETMECH are all involved in the field change process and all impact on its success or failure. Many of the problems associated with multiple model items can be attributed to the field change process. These include the lack of timely MRP support and the proper technical documentation. The poorly structured information channels between NAVELEX and SPCC and the long installation schedules aggravate these problems.

VI. CONCLUSIONS AND RECOMMENDATIONS

Multiple model electronic equipment has become a fact of life in today's environment of rapidly advancing electronic technology. Efforts need to be made to insure that new models are not introduced into service unnecessarily and that when they are required that the logistic support for these new models is managed in an effective mannner.

One of the most effective means for reducing the number of multiple model equipment is to use detailed specifications for reprocurement whenever practical. This would require NAVELEX and SPCC to purchase design data that is sufficient for reprocurement purposes whenever the equipment is expected to be procured again at a later date. Although this may not be feasible for all of the thousands of electronic equipments managed by NAVELEX and SPCC, new components could probably be identified for which the potential life cycle costs of not doing so are large enough to justify the purchase.

Another method for reducing the number of multiple models is to insure that when field changes to equipment are proposed that they are necessary to correct a known deficiency and not for cosmetic reasons. The NAVELEX CCBs should compare the relative advantages of the change to improved performance to the disadvantages created in operating and supporting the multiple models which may result.

Where multiple model equipment does exist, efforts should be made to provide them with adequate MRP support. One of the major reasons that multiple model items experience MRP support difficulties is the lack of timely feedback to SPCC from NAVELEX that new MRP requirements have been generated by the introduction of a new model of electronic equipment into service. There are currently three methods by which SPCC is notified of these changes in MRP requirements:

1. Provision Guidance Conferences;
2. APL Update requests; and
3. CCB Directives.

Provisioning Guidance Conferences are the best method for NAVELEX to notify SPCC of the procurement of new models of electronic equipment. NAVELEX should ensure that the Provisioning Guidance Conferences are held at the earliest possible date and that the provisioning technical documentation provided to SPCC is as complete and accurate as possible. SPCC should ensure that possible support problems are highlighted at the conferences and that efforts are coordinated with the NAVELEX Project Managers to overcome those problems.

APL update requests are limited in their effectiveness in providing SPCC with timely information on the changes in MRP support requirements for electronic equipment. One reason is the limited number of rewrites that NAVELEXDETMECH is capable of performing. Another is that APL rewrites are usually confucted after the changes to the equipment have been made.

CCB Directives offer an excellent method for notifying both SPCC and NAVELEXDETMECH of authorized changes in electronic equipment and the changes in logistics support required. CCB Directives are issued prior to the changes in the equipment being made and are therefore a source of timely information. NAVELEX should require that all ECPs and CCB Directives are processed through ELEX 8123 and require that copies be routed to SPCC and NAVELEXDETMECH.

NAVELEX contracts for the procurement of new electronic equipment contain an option clause under which SPCC can order MRPs to support the new equipment. If this clause were also included in contracts for the reprocurement of multiple model equipment and if it was used by SPCC, it could help to eliminate delays in MRP availability experienced by new models.

The lack of complete and up-to-date technical data at SPCC also affects MRP support for multiple model electronic equipment. NAVELEXDETMECH does not have the capability at this time to review all SPCC contracts for electronic parts to support NAVELEX equipment and SPCC can not rely on the contractor to notify them of errors in the data. SPCC must assume that the technical data it has on hand is accurate, therefore NAVELEX should make a continuing effort to ensure data accurary for parts that they expect SPCC to reprocure.

Four topics for further research are suggested. The first is that the final optimal inventory model of Hadley and Whitin be examined for possible use at SPCC for managing

inventories of electronic equipment. The second topic is an investigation into the feasibility of an information exchange system to better account for changes in shipboard electronic equipment configurations between overhauls. The system should include NAVELEX, SPCC and the operational units. The third recommendation is that a study be conducted to examine the current nature of field changes to see if they are being accomplished to correct design deficiencies or are for cosmetic purposes. The final topic is that a tradeoff analysis should be made between the alternatives of buying and not buying elaborate technical data. Key to this analysis would be the determination of the life cycle costs under each alternative.

APPENDIX A

SYSTEMS COMMANDS CRITERIA FOR IDENTIFYING RETENTION ITEMS DURING STOCK COORDINATION REVIEWS [Ref. 8]

1. Criteria

a. Items Managed at Systems Command Level

Items managed by Systems Command (or their field activities) will be limited to items meeting one or more of the following criteria:

(1) Items in a Research and Development Stage. Items qualifying under this category must be under development and not yet in Fleet operational use.

(2) Items Requiring Engineering Control Decisions. This criterion is applicable when a high degree of engineering judgment is required concerning design or relationships to a system. It pertains principally to those items requiring engineering decisions during production or prior to each issue. Items that remain in this category after two years of operational use must be justified in the same manner as Criteria Code Four items of this Instruction.

(3) Items Unstable In Design. Items which are determined by an engineering decision to be highly subject to design change of the item itself, or replacement of the item through modification of

its next higher assembly. End items, components, assemblies, test and evaluation equipment unstable in design do not exclude their intrinsic parts from stock coordination review. Items retained for managment under this category will be transferred to an ICP after completion of two years operational use unless a major design change or modification has been approved and/or being accomplished at the time of the Stock Coordination Review. Further retention upon completion of the approved design change or modification must be justified in accordance with Criteria Code Four.

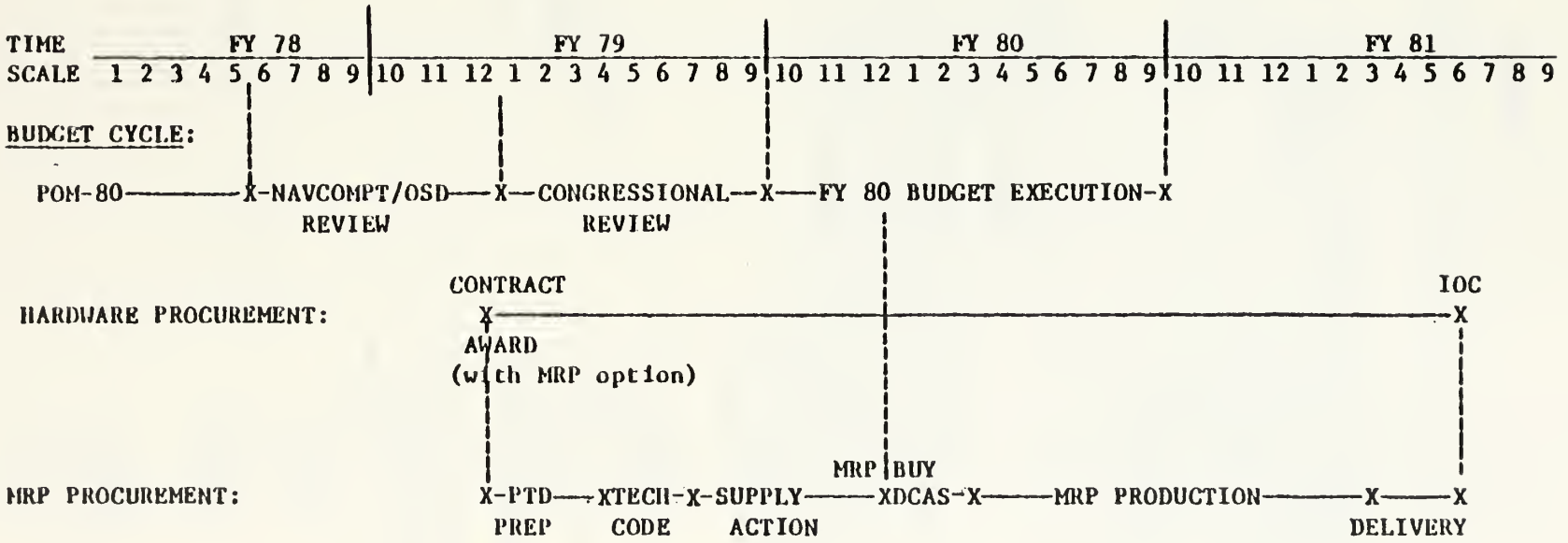
(4) Items Expressly Assigned to a Single Command Management by Seperate Authorizing NAVMAT Directives. Items qualifying for this category are limited to items of major importance and depot level repairables. Inclusion in this category is a matter for CNM decision based upon justifying rationale submitted by the originating Command. As a general rule items changed from Criteria Codes Two and Three into this code will be transferred to an ICP for inventory management even though the procurement function remains at the headquarters level. Items assigned under this criterion will be considered as an adjunct to

stock coordination and therefore, are not precluded from formal review when scheduled.

APPENDIX B

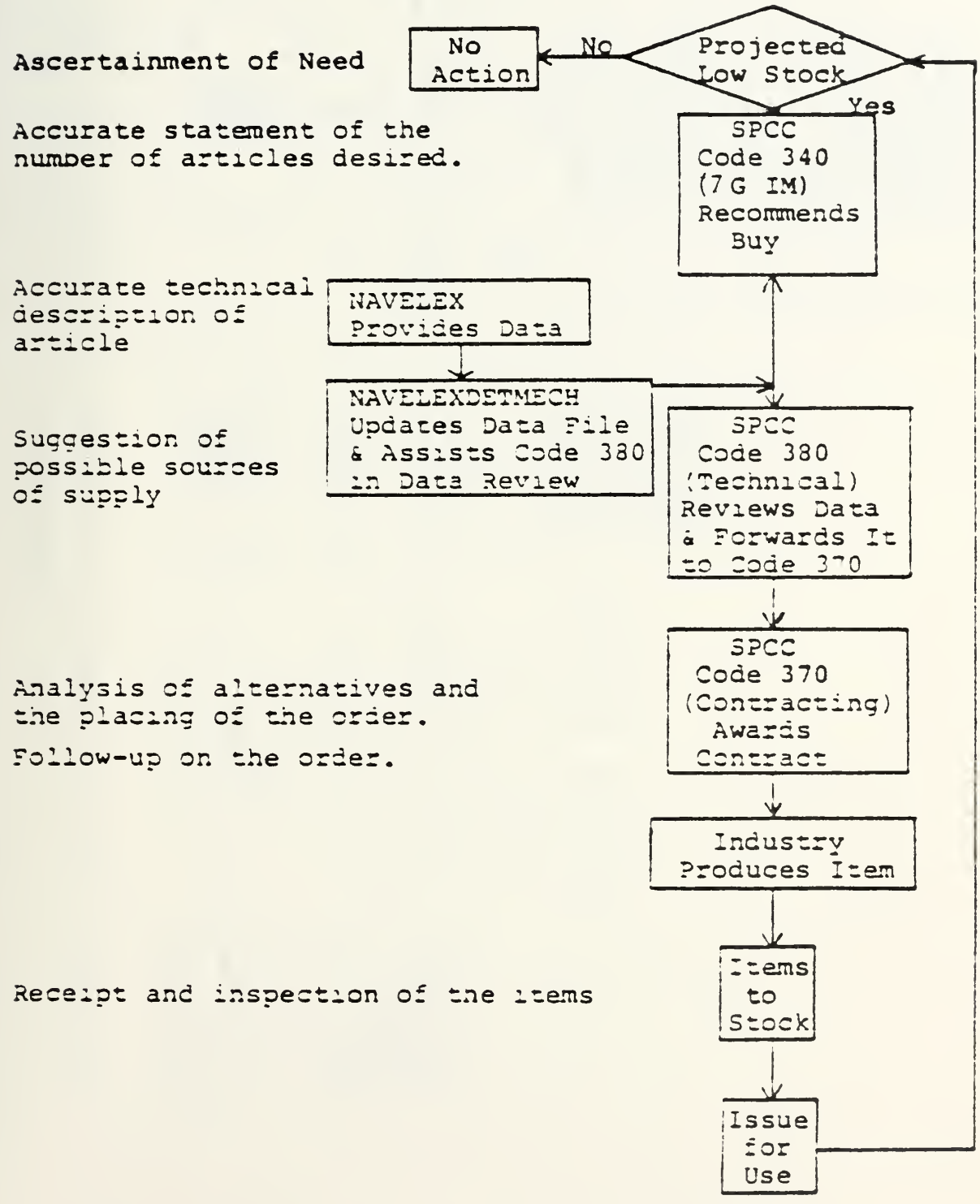
BUDGET LEAD TIME FOR MAINTENANCE REPAIR PARTS [Ref. 17]

EXAMPLE: Hardware procurement lead time (PLT) is 30 months.
Maintenance Repair Parts (MRP) are produced in 12 months.
Provisioning Technical Documentation (PTD) is delivered 120 days after Contract Award.
Initial Operational Capability (IOC) in FY 81.
Maintenance Repair Parts (MRP) are ordered under contract option in FY 80.
FY 80 Budget Development commenced during POM-80 in FY 78.


TIME
FY 78
FY 79
FY 80
FY 81
SCALE 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9
BUDGET CYCLE:
POM-80
NAVCOMPT/OSD REVIEW
CONGRESSIONAL REVIEW
FY 80 BUDGET EXECUTION
HARDWARE PROCUREMENT:
CONTRACT AWARD (with MRP option)
IOC
MRP PROCUREMENT:
PTD PREP
XTECH CODE
SUPPLY ACTION
MRP BUY
XDCAS
MRP PRODUCTION
DELIVERY

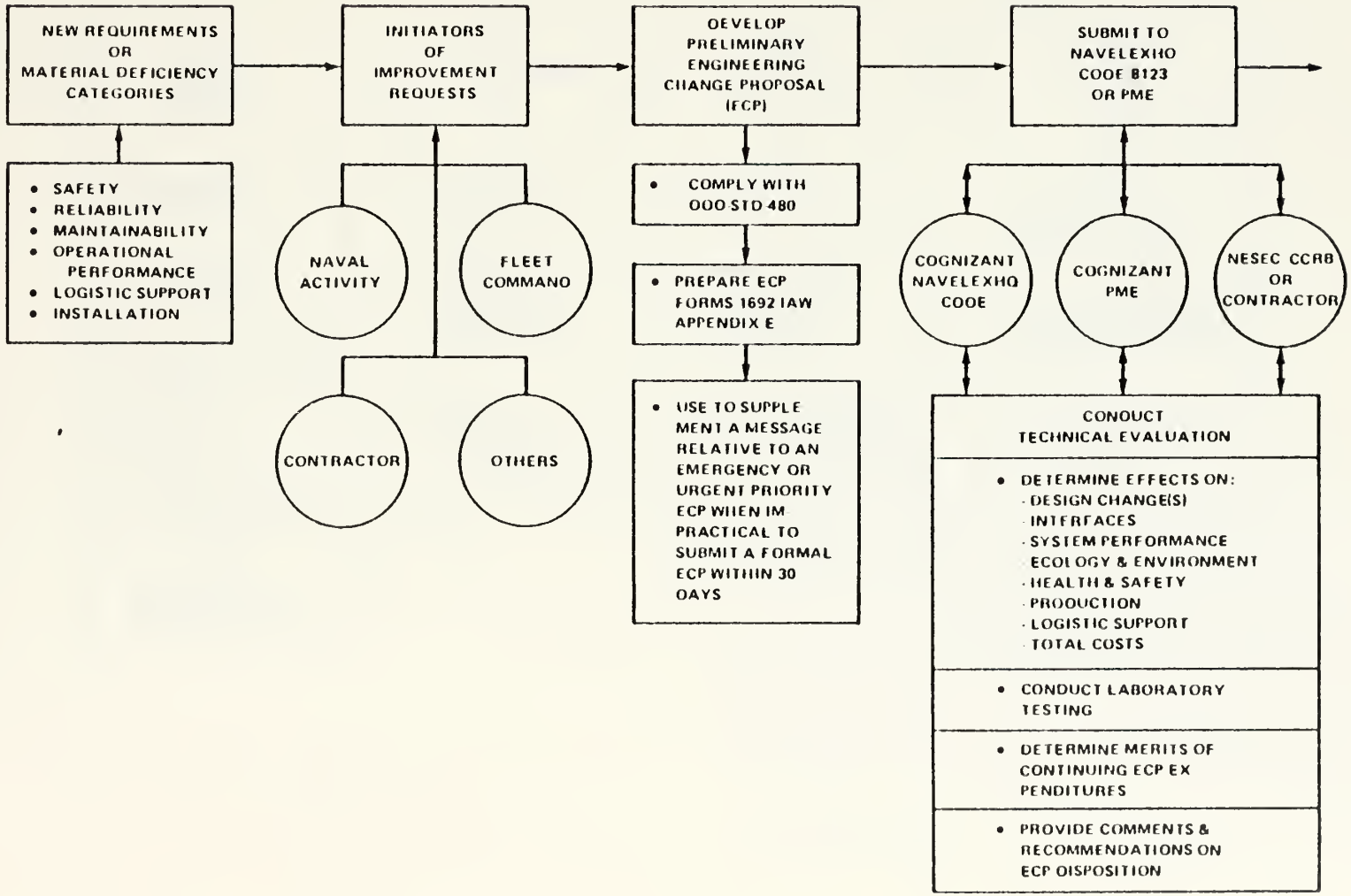
APPENDIX C

THE SPCC 7G ACQUISITION PROCESS [Ref. 5:22]

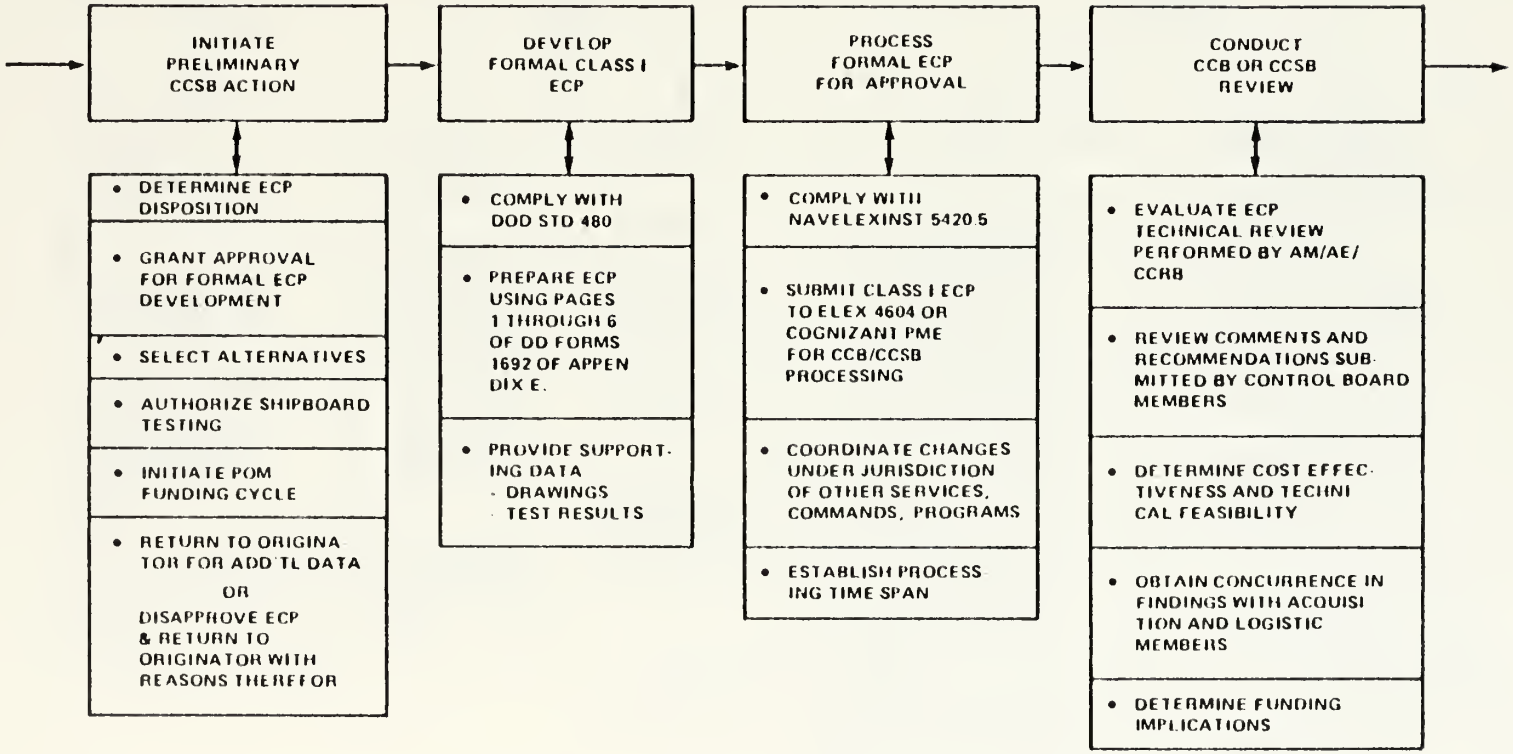

Ascertainment of Need
Projected Low Stock
No
No Action
Yes
Accurate statement of the number of articles desired.
SPCC Code 340 (7G IM) Recommends Buy
Accurate technical description of article
NAVELEX Provides Data
NAVELEXDETMECH Updates Data File & Assists Code 380 in Data Review
Suggestion of possible sources of supply
SPCC Code 380 (Technical) Reviews Data & Forwards It to Code 370
SPCC Code 370 (Contracting) Awards Contract
Analysis of alternatives and the placing of the order.
Follow-up on the order.
Industry Produces Item
Items to Stock
Receipt and inspection of the items
Issue for Use

APPENDIX D

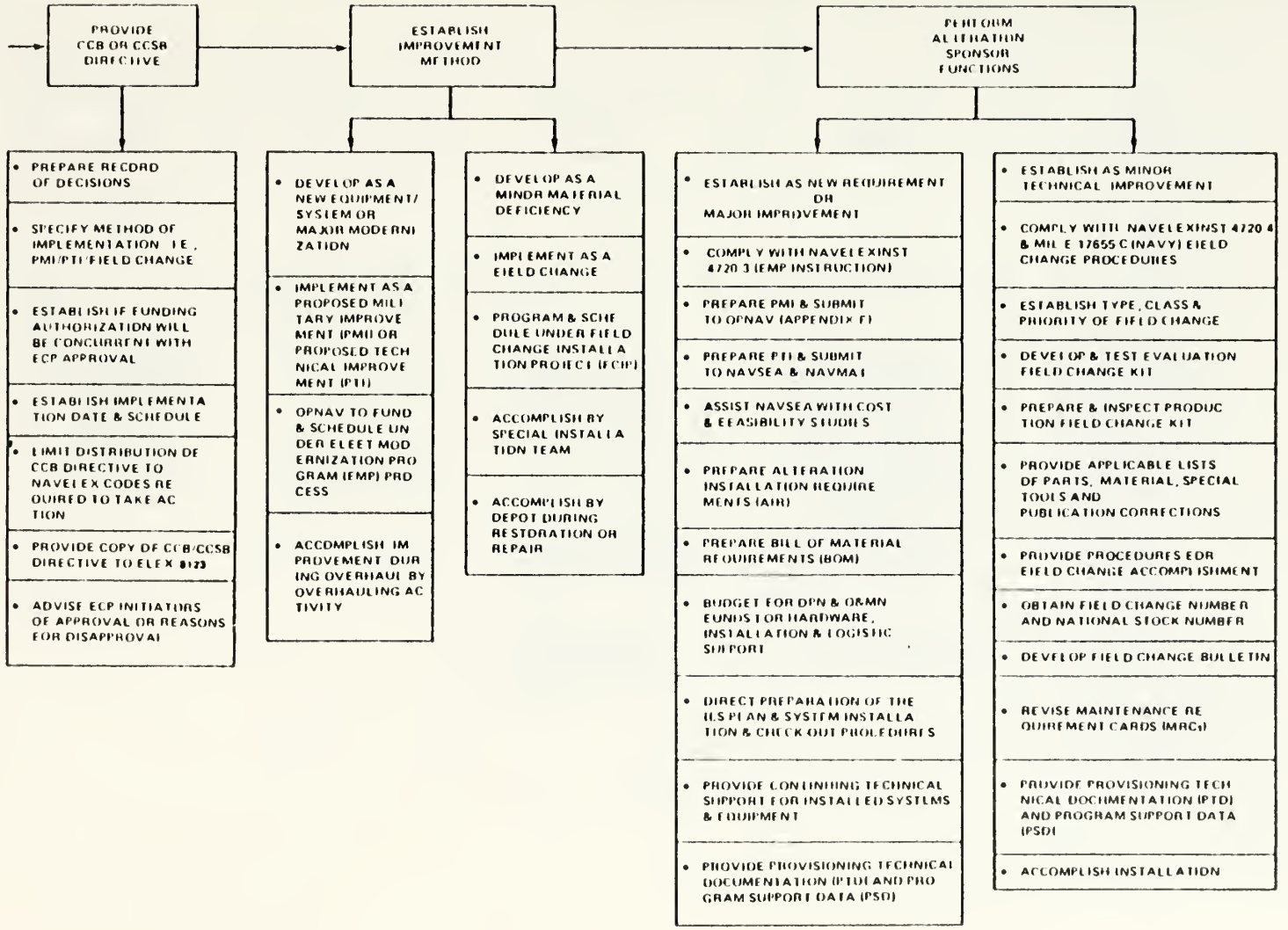
ENGINEERING CHANGE IMPLEMENTATION PROCEDURES FLOW DIAGRAM [Ref. 20:I-6]


NEW REQUIREMENTS OR MATERIAL DEFICIENCY CATEGORIES
• SAFETY
• RELIABILITY
• MAINTAINABILITY
• OPERATIONAL PERFORMANCE
• LOGISTIC SUPPORT
• INSTALLATION
INITIATORS OF IMPROVEMENT REQUESTS
NAVAL ACTIVITY
FLEET COMMANO
CONTRACTOR
OTHERS
OEVELOP PRELIMINARY ENGINEERING CHANGE PROPOSAL (ECP)
• COMPLY WITH OOO STD 480
• PREPARE ECP FORMS 1692 IAW APPENDIX E
• USE TO SUPPLE MENT A MESSAGE RELATIVE TO AN EMERGENCY OR URGENT PRIORITY ECP WHEN IM PRACTICAL TO SUBMIT A FORMAL ECP WITHIN 30 OAYS
SUBMIT TO NAVELEXHO COOE 8123 OR PME
COGNIZANT NAVELEXHQ COOE
COGNIZANT PME
NESEC CCRB OR CONTRACTOR
CONOUCT TECHNICAL EVALUATION
• DETERMINE EFFECTS ON:
- DESIGN CHANGE(S)
- INTERFACES
- SYSTEM PERFORMANCE
- ECOLOGY & ENVIRONMENT
- HEALTH & SAFETY
- PRODUCTION
- LOGISTIC SUPPORT
- TOTAL COSTS
• CONDUCT LABORATORY TESTING
• DETERMINE MERITS OF CONTINUING ECP EX PENDITURES
• PROVIDE COMMENTS & RECOMMENDATIONS ON ECP OISPOSITION

ENGINEERING CHANGE IMPLEMENTATION PROCEDURES FLOW DIAGRAM (continued)

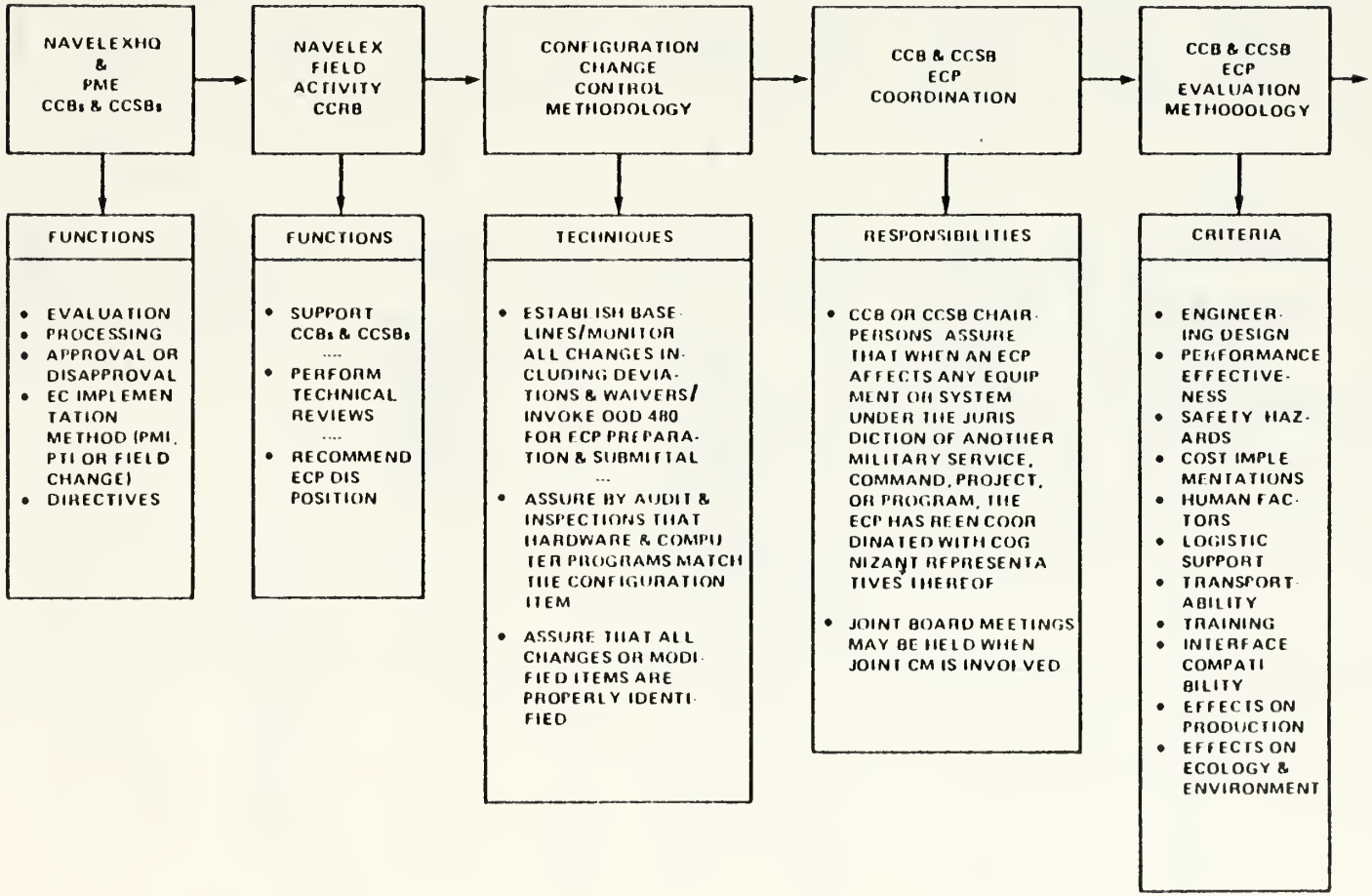

INITIATE PRELIMINARY CCSB ACTION
DEVELOP FORMAL CLASS I ECP
PROCESS FORMAL ECP FOR APPROVAL
CONDUCT CCB OR CCSB REVIEW
• DETERMINE ECP DISPOSITION
• GRANT APPROVAL FOR FORMAL ECP DEVELOPMENT
• SELECT ALTERNATIVES
• AUTHORIZE SHIPBOARD TESTING
• INITIATE POM FUNDING CYCLE
• RETURN TO ORIGINATOR FOR ADD'TL DATA OR DISAPPROVE ECP & RETURN TO ORIGINATOR WITH REASONS THEREFOR
• COMPLY WITH DOD STD 480
• PREPARE ECP USING PAGES 1 THROUGH 6 OF DD FORMS 1692 OF APPENDIX E.
• PROVIDE SUPPORTING DATA
- DRAWINGS
- TEST RESULTS
• COMPLY WITH NAVELEXINST 5420.5
• SUBMIT CLASS I ECP TO ELEX 4604 OR COGNIZANT PME FOR CCB/CCSB PROCESSING
• COORDINATE CHANGES UNDER JURISDICTION OF OTHER SERVICES, COMMANDS, PROGRAMS
• ESTABLISH PROCESSING TIME SPAN
• EVALUATE ECP TECHNICAL REVIEW PERFORMED BY AM/AE/CCRB
• REVIEW COMMENTS AND RECOMMENDATIONS SUBMITTED BY CONTROL BOARD MEMBERS
• DETERMINE COST EFFECTIVENESS AND TECHNICAL FEASIBILITY
• OBTAIN CONCURRENCE IN FINDINGS WITH ACQUISITION AND LOGISTIC MEMBERS
• DETERMINE FUNDING IMPLICATIONS

ENGINEERING CHANGE IMPLEMENTATION PROCEDURES FLOW DIAGRAM (continued)

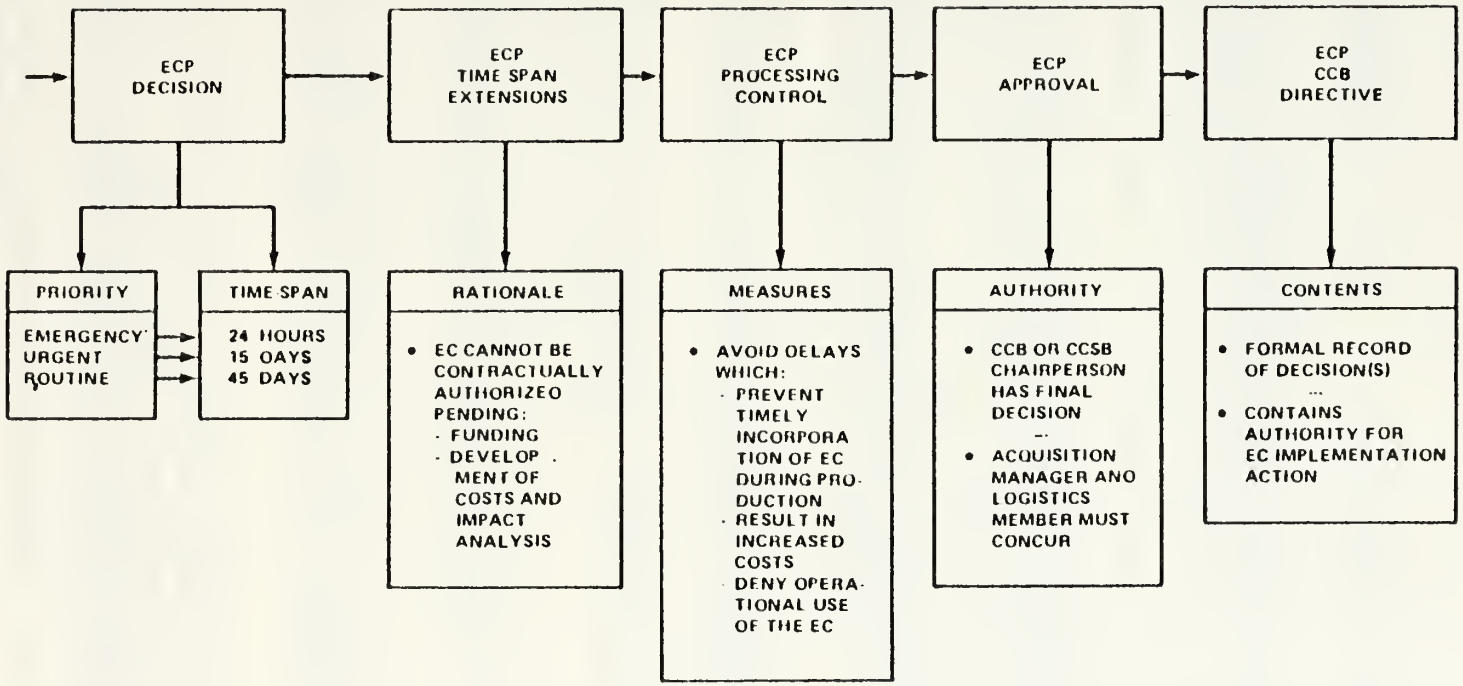

PROVIDE CCB OR CCSB DIRECTIVE
ESTABLISH IMPROVEMENT METHOD
PERFORM ALTERATION SPONSOR FUNCTIONS
• PREPARE RECORD OF DECISIONS
• SPECIFY METHOD OF IMPLEMENTATION I E , PMI/PTI/FIELD CHANGE
• ESTABLISH IF FUNDING AUTHORIZATION WILL BE CONCURRENT WITH ECP APPROVAL
• ESTABLISH IMPLEMENTATION DATE & SCHEDULE
• LIMIT DISTRIBUTION OF CCB DIRECTIVE TO NAVELEX CODES REQUIRED TO TAKE ACTION
• PROVIDE COPY OF CCB/CCSB DIRECTIVE TO ELEX 8123
• ADVISE ECP INITIATORS OF APPROVAL OR REASONS FOR DISAPPROVAL
• DEVELOP AS A NEW EQUIPMENT/ SYSTEM OR MAJOR MODERNIZATION
• IMPLEMENT AS A PROPOSED MILITARY IMPROVEMENT (PMI) OR PROPOSED TECHNICAL IMPROVEMENT (PTI)
• OPNAV TO FUND & SCHEDULE UNDER FLEET MODERNIZATION PROGRAM (FMP) PROCESS
• ACCOMPLISH IMPROVEMENT DURING OVERHAUL BY OVERHAULING ACTIVITY
• DEVELOP AS A MINOR MATERIAL DEFICIENCY
• IMPLEMENT AS A FIELD CHANGE
• PROGRAM & SCHEDULE UNDER FIELD CHANGE INSTALLATION PROJECT (FCIP)
• ACCOMPLISH BY SPECIAL INSTALLATION TEAM
• ACCOMPLISH BY DEPOT DURING RESTORATION OR REPAIR
• ESTABLISH AS NEW REQUIREMENT OR MAJOR IMPROVEMENT
• COMPLY WITH NAVELEXINST 4720 3 (FMP INSTRUCTION)
• PREPARE PMI & SUBMIT TO OPNAV (APPENDIX F)
• PREPARE PTI & SUBMIT TO NAVSEA & NAVMAT
• ASSIST NAVSEA WITH COST & FEASIBILITY STUDIES
• PREPARE ALTERATION INSTALLATION REQUIREMENTS (AIR)
• PREPARE BILL OF MATERIAL REQUIREMENTS (BOM)
• BUDGET FOR OPN & O&MN FUNDS FOR HARDWARE, INSTALLATION & LOGISTIC SUPPORT
• DIRECT PREPARATION OF THE ILS PLAN & SYSTEM INSTALLATION & CHECK OUT PROCEDURES
• PROVIDE CONTINUING TECHNICAL SUPPORT FOR INSTALLED SYSTEMS & EQUIPMENT
• PROVIDE PROVISIONING TECHNICAL DOCUMENTATION (PTD) AND PROGRAM SUPPORT DATA (PSD)
• ESTABLISH AS MINOR TECHNICAL IMPROVEMENT
• COMPLY WITH NAVELEXINST 4720 4 & MIL E 17555C (NAVY) FIELD CHANGE PROCEDURES
• ESTABLISH TYPE, CLASS & PRIORITY OF FIELD CHANGE
• DEVELOP & TEST EVALUATION FIELD CHANGE KIT
• PREPARE & INSPECT PRODUCTION FIELD CHANGE KIT
• PROVIDE APPLICABLE LISTS OF PARTS, MATERIAL, SPECIAL TOOLS AND PUBLICATION CORRECTIONS
• PROVIDE PROCEDURES FOR FIELD CHANGE ACCOMPLISHMENT
• OBTAIN FIELD CHANGE NUMBER AND NATIONAL STOCK NUMBER
• DEVELOP FIELD CHANGE BULLETIN
• REVISE MAINTENANCE REQUIREMENT CARDS (MRCs)
• PROVIDE PROVISIONING TECHNICAL DOCUMENTATION (PTD) AND PROGRAM SUPPORT DATA (PSD)
• ACCOMPLISH INSTALLATION

APPENDIX E

NAVELEX CONFIGURATION (CHANGE) CONTROL PROCEDURES DIAGRAM [Ref. 20:IV-5]


NAVELEXHQ & PME CCBs & CCSBs
NAVELEX FIELD ACTIVITY CCRB
CONFIGURATION CHANGE CONTROL METHODOLOGY
CCB & CCSB ECP COORDINATION
CCB & CCSB ECP EVALUATION METHOOOLOGY
FUNCTIONS
• EVALUATION
• PROCESSING
• APPROVAL OR DISAPPROVAL
• EC IMPLEMEN TATION METHOD (PMI, PTI OR FIELD CHANGE)
• DIRECTIVES
FUNCTIONS
• SUPPORT CCBs & CCSBs
• PERFORM TECHNICAL REVIEWS
• RECOMMEND ECP DIS POSITION
TECHNIQUES
• ESTABLISH BASE LINES/MONITOR ALL CHANGES IN CLUDING DEVIA TIONS & WAIVERS/ INVOKE OOD 480 FOR ECP PREPARA TION & SUBMITTAL
• ASSURE BY AUDIT & INSPECTIONS THAT HARDWARE & COMPU TER PROGRAMS MATCH THE CONFIGURATION ITEM
• ASSURE THAT ALL CHANGES OR MODI FIED ITEMS ARE PROPERLY IDENTI FIED
RESPONSIBILITIES
• CCB OR CCSB CHAIR PERSONS ASSURE THAT WHEN AN ECP AFFECTS ANY EQUIP MENT OR SYSTEM UNDER THE JURIS DICTION OF ANOTHER MILITARY SERVICE, COMMAND, PROJECT, OR PROGRAM, THE ECP HAS BEEN COOR DINATED WITH COG NIZANT REPRESENTA TIVES THEREOF
• JOINT BOARD MEETINGS MAY BE HELD WHEN JOINT CM IS INVOLVED
CRITERIA
• ENGINEER ING DESIGN
• PERFORMANCE EFFECTIVE NESS
• SAFETY HAZ ARDS
• COST IMPLE MENTATIONS
• HUMAN FAC TORS
• LOGISTIC SUPPORT
• TRANSPORT ABILITY
• TRAINING
• INTERFACE COMPATI BILITY
• EFFECTS ON PRODUCTION
• EFFECTS ON ECOLOGY & ENVIRONMENT

NAVELEX CONFIGURATION (CHANGE) CONTROL PROCEDURES DIAGRAM (continued)



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